

THE SPIDERS AND SCORPIONS OF BARKUDA ISLAND.

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(Plates XVII—XIX.)

Barkuda is an island situated in the Ganjam District of the Madras Presidency in the southern part of the Chilka Lake. Its general features have been described by Annandale (*Mem. As. Soc. Beng.* VII, No. 4 in the press). Its fauna is not a rich one, a fact which facilitates detailed biological work ; and a careful study of its spiders has revealed many features of interest. The scorpions have been less fully studied.

Order SCORPIONES.

Family BUTHIDAE.

***Charmus laneus*, Karsch.**

Charmus laneus, Pocock, 1900, p. 32.

Three specimens found among loose soil and bark at the foot of trees in the rains.

***Lychas scaber*, Pocock.**

Lychas scaber, Pocock, 1900, p. 38.

Not uncommon under loose bark.

***Isometrus assamensis*, Oates.**

Isometrus assamensis, Pocock, 1900, p. 48.

Not uncommon in the house.

Order ARANEAE.

Suborder MYGALOMORPHAE.

Family CTENIZIDAE.

***Acanthodon barkudensis*, sp. nov.**

Text-fig. 1, *b-e* ; pl. xvii, figs. 4-6 ; pl. xviii, fig. 9.

Also found at Rambha on the mainland at the southern end of the Chilka Lake.

A large and obese spider of a dark greenish black hue, becoming paler and browner in spirit. It forms somewhat short broad burrows lined with closely adherent silk and closed by a strong and closely fitting trap-door (pl. xvii, figs. 4-6; pl. xviii, fig. 9), to which the spider clings vigorously when any attempt to open it is made, retreating as a rule only when it has been forced open. These burrows are commonly found in soil that has accumulated among adventitious *Ficus* roots, where these anastomose over the surface of the trunk. They are also found in termite mounds. They are usually more or less horizontal, the trap-door, which is very firm and strong, being hinged on or towards the upper margin. Males were obtained in August, but not later.



TEXT-FIG. 1.

- a. *Acanthodon constructor* ♀, eyes.
 b. " *barkudensis* ♀, eyes.
 c. " " ♂, palpal organ.
 d. " " ♂ eyes.
 e. " " ♂, end of tibia of first leg with apophysis.
 f. *Damarchus excavatus* ♂ junction of tibia and tarsus of right first leg from below; hairs omitted.

♀ Total length up to about 23 mm. exclusive of chelicerae and spinnerettes. Length of carapace 10 mm., breadth 9 mm.

The coxa of the 4th leg is without spinules below and the tibia of the 3rd leg is slightly longer than wide. In this respect the species resembles *A. crassus* and *A. opifex*, but it differs from both in having the anterior median eyes only about half a diameter apart. They are about twice as large as the posterior medians which are situated about as far behind them as the anterior medians are from each other. The posterior medians are separated by a space equal to nearly three of their own dia-

meters, their outermost points being almost as far apart as those of the anterior medians. The posterior laterals are long and narrow, and markedly oblique, their posterior ends being separated from the posterior medians by about one posterior median diameter, and their anterior ends from the anterior medians by about one anterior median diameter. The anterior laterals are very strongly prominent, more so than in *A. constructor* from Madras, which also has the anterior and posterior medians of almost equal size, and the latter occupying a much wider area than the former (text-fig. 1a). The protarsi of the 3rd and 4th legs are much narrower distally than at the base, and the tarsi of these legs are distinctly more slender than in *A. constructor*.

♂ Males have only been found in August, and then much more rarely than females. They vary considerably in size. The type specimen has a total length of 11 mm., its carapace being $5\frac{1}{2}$ mm. long by 5 mm. broad. The eyes (text-fig. 1e) are more compact than in the female (this is more marked even than in *A. constructor*) and the anterior laterals are somewhat less prominent. Their arrangement otherwise resembles that of the female. The tibia of the palp (text-fig. 1c) is inflated and furnished distally with a ventral concavity whose outer margin is bordered by stout spines which are longer at the two ends than in the middle. This concavity is longer and shallower than in *A. constructor*, occupying rather more instead of less than half the length of the tibia, and not forming a complete semicircle. The tarsus has a somewhat rounded external process distally. The spine of the palpal organ is broad at the base, slender and bent distally with blunt tip, much as in *A. constructor*. The tibia of the first leg is practically straight. It bears a row of spines on its outer side as in *A. constructor*, and has its distal extremity armed on the inner side with two tubercles situated one behind the other as in that species, but somewhat smaller (text-fig. 1e). The proximal tubercle is a simple conical process, somewhat blunter than in *A. constructor*. The distal one is longer and is strongly grooved both above and below; it is somewhat slenderer than in *A. constructor* distally. The protarsus lacks the large submedian conical spur characteristic of *A. constructor*.

The spinules on the hind coxae, which help to distinguish the female of *A. constructor* from that of *A. barkudensis*, are not found in the male.

Nemesiellus sp.

Pl. xviii, fig. 8.

This species appears to be darker in colour than *N. montanus* but as it fades in spirit from dark olive green to brownish it is possible that it may fade still further. It resembles *N. montanus* in all other points mentioned in Pocock's very brief description (1900, pp. 167-8) but differs from specimens which I have recently obtained from an altitude of about 6500-7000 ft. in the Nilgiris in the dentition of the mandibles, a character not referred to in the

description of *N. montanus*¹ The Nilgiri specimens resemble the Barkuda ones in size and colour. Only females have been obtained. They attain a total length of 26 mm. with the carapace $10\frac{1}{2}$ mm. long by $8\frac{1}{2}$ mm. broad.

The burrow (pl. xviii, fig. 8) is more or less vertical and much longer than that of *Acanthodon barkudensis*. The silk with which it is lined is of a somewhat firm consistency and may readily be withdrawn from the burrow in tubular form. It is continued beyond the mouth of the burrow as a somewhat thin and flexible flap, which forms the trap-door, covering the entrance, but not strong enough to close it securely. When disturbed, therefore, the spider retreats at once into the depths of its burrow which are commonly so completely surrounded by tree roots as to make its capture by digging almost impossible. Sometimes, however, this species may also be found in termite mounds.

The Nilgiri specimens were found on a roadside cutting where their burrows were easily dug out. They bifurcated near the bottom, and had a trapdoor between the two arms. Nothing of the sort was noticed in the few burrows that I dug out under less favourable conditions on Barkuda Island. The trapdoor at the entrance to the nest of the Nilgiri species resembled that of the Barkuda species, but was on the vertical face of the cutting instead of on a horizontal surface.

***Damarchus excavatus*, sp. nov.**

Text-fig. 1/; pl. xviii, fig. 7.

Also found at Balasore, Orissa (female only).

A spider of moderate size, dark brown in colour with conspicuous oblique whitish markings on the dorsal surface of the abdomen. It forms long narrow oblique burrows whose entrance is not closed by a trap-door, but is surrounded by a more or less definite lip composed of small particles of soil fastened together with silk. Often the burrows are completely shut off from the surface, ending in an upwardly directed tube with domed roof about an inch from the surface. In the case of a specimen which constructed its tube against the side of a glass jar the only entrance to the tube was closed thus for several weeks, and I think it probable that this is done whenever the spider is not hungry. The burrows are usually found in light soil under trees and bushes in considerable numbers, and it is not impossible that they may branch and open into each other, but I have not succeeded in finding anything of the sort. This, however, must not be taken as proof that it does not exist, as it is by no means easy to trace the burrows far. Males were sought at intervals from August to December, but were not obtained till the latter month.

♀ Total length up to about 16 mm. Length of carapace

¹ Mr. Hirst informs me that the Nilgiri specimens agree with *N. montanus* in dentition so far as he can judge from the immature type of that species.

5½ mm., breadth 4 mm. Distinctly smaller than the females of *D. assamensis* in which Hirst (1909, pp. 383-4) was unable to find any structural difference from *D. oatesi*. The largest of the three females of *D. assamensis* in the Indian Museum collection is about 20 mm. long, with a carapace 8 mm. long by 5½ broad. Thorell gives the length of females of *D. oatesi* as 22 mm., the carapace being 9 mm. long by 6½ mm. broad (1895, p. 5). The legs of *D. excavatus* are shorter and thinner than in *D. assamensis*, the tarsus and protarsus of the fourth pair being together distinctly shorter than the carapace instead of about equal to it (4½ mm. in type-specimen with carapace 5½ mm. long).

♂ Length 10-11½ mm. when mature. Carapace 5-5½ mm. long by 2½-3 mm. broad. This spider is thus decidedly smaller than the male of either *D. oatesi* or *D. assamensis*. It differs from both these species in having the tibia of the palp about twice instead of three times as long as broad, and also in the form of the tibial apophysis which is very stout with an abrupt inward bend distally. The base of the protarsus of the first leg (text-fig. 1f) is strongly excavate on the inner side, as though to accommodate the tibial apophysis, and the distal border of the excavation bears a very distinct group of thick-set denticles. There is no such excavation or group of denticles in *D. assamensis*.

Family BARYCHELIDAE.

Diplothele walshi, Cambridge.

Pl. xviii, fig. 11.

Diplothele walshi, Poc. 1900, p. 175.

The species commonly known by this name was also described by its collector, J. H. Tull Walsh, under the name *Adelonychia nigrostriata* (*Journ. As. Soc. Beng.* LIX [ii], pp. 269-270). It is unfortunate that the burrow of the type specimen was not described, as the empty burrow which is described undoubtedly belonged to a different and much larger species and agrees in its characteristics with the burrows of *Acanthodon barkudensis* and *constructor*. *Diplothele walshi* never attains any large size, a mature specimen which was taken with young in its nest being only 9 mm. long; and Walsh must therefore have been wrong in supposing that the type-specimen (10 mm. long) was immature.

I have never myself found its burrow associated with burrows of *Acanthodon*. *Acanthodon* usually (though not always) chooses firmer soil in a more exposed situation for its burrow, and finds sites specially suitable for its burrows among the adventitious roots of Banyans and other species of *Ficus*. *Diplothele walshi* constructs a small chamber, usually in light soil under bushes, often against the base of a tree. The upper wall of this chamber is on a level with the surrounding soil, and is pierced by two apertures, each closed by a neatly made trap-door of the "wafer" type about 6 mm. in diameter in the nest

of a full-grown spider. The two doors open outwards, as in the nest of spiders of the genus *Sason* (Pocock, 1900, p. 173 ; Gravely, 1915 *a*, p. 265 and *b*, p. 533), but are separated by a space equal to their own diameter, or even more, instead of being hinged together as in that genus, the chamber being deeper and more like a curved tube (compare figs. 10 and 11 of pl. xviii).

***Sasonichus arthropophysis*, Gravely.**

Pl. xviii, fig. 12.

Sasonichus arthropophysis, Gravely, 1915 *a*, pp. 264-5.

A moderately large dark brown spider with reddish femora. The male with tibiae adorned distally by whitish hairs, which lose their characteristic appearance at once when put into spirit. The nest is constructed among stones and more or less loose soil and rubbish among the roots of Banyans, Pipals, etc. It consists of a short and almost straight tube somewhat swollen in the middle and closed at each end by a trap-door which is always hinged on the lower side, so that it hangs open when not held in place by the spider. Empty nests are thus somewhat conspicuous objects, the whitish lining of the trap-door contrasting with the mouth of the dark burrow above it. The trap-door of a full grown spider is about 10 mm. in diameter. Males were obtained in August, but not later.

♀ The female has not yet been described. The single spirit specimen at present before me is slightly under 20 mm. in length ; it is probably mature, but the abdomen is frequently much more distended than in this specimen. Its carapace is about 8 mm. long by 6 mm. wide. In spirit specimens the carapace, chelicerae (except the extreme base), last three joints of the palps and last four joints of the legs are of a dull sepia tint somewhat paler than the blacker abdomen and darker than the spinnerettes. In life all these parts are practically black. The sternum, coxae, trochanters and femora are ochraceous in spirit, reddish in life, except for a brownish dorsal line on the femora, which expands across the whole dorsal surface distally. The ocular tubercle is yellowish in the spirit specimen before me, but black like the rest of the carapace in the living one. The eyes resemble those of the male. The carapace is relatively somewhat narrower and more elevated than in the male, and the legs are somewhat less slender.

Family THERAPHOSIDAE.

***Plesiophrictus* sp.**

This species, like others of the group of genera to which it belongs (Gravely, 1915 *b*, p. 533), appears to make no burrow. It lives among loose soil and stones at the base of *Ficus* trees. It is not common and in the absence of mature males it cannot be described satisfactorily.

Suborder ARANEAE VERAE.

Family ULOBORIDAE.

A small black *Uloborus* is common among webs of *Cyrtophora cicatrosa*. This or a closely allied species appears to have a wide distribution in India and Burma, where it occurs in association with *C. citricola* as well as with *C. cicatrosa*. It is much smaller than *U. servulus*, Simon, which was found in association with a *Cyrtophora* of great size in Venezuela (Simon 1892 *a*, p. 213; 1892 *b*, p. 427).

The Uloborid already reported from Cochin (Gravely, 1915 *b*, p. 534), which spins a remarkable snare consisting of a horizontal orb-web above a funnel of different mesh, has also been found on Barkuda Island. It belongs to the genus *Uloborus* and though distinct from, is evidently related to, *U. quadri-tuberculatus*, Thorell in Mss., which is figured with its similar web by Workman (1896, pl. 18).

Family DICTYNIDAE.

Amaurobius sp.

A brown spider (becoming paler in spirit) of moderate size, spinning an untidy cobweb on leaves and twigs round about its lair. The lair is usually concealed in one or two curled leaflets, often of the common jungle shrub, *Glycosmis pentaphylla*, or may be beneath the spines of a Prickly Pear.

A single male was obtained in August.

This appears to be the first record of the genus from India, though *A. taprobanicola* was described by Strand (1907, p. 110, figs. 49-50b) from Ceylon. In the absence of the description of *A. taprobanicola* and of specimens of other species for comparison I prefer to leave the Barkuda form undescribed at present.

Dictyna spp.

Pl. xvii, figs. 2-3.

Two of the Barkuda spiders appear to belong to the genus *Dictyna*. One is a minute brown spider which spins untidy little cobwebs over the twigs of a Caperid bush, hiding itself in the fork formed by a leaf stalk or a second twig.

The other is a small bright green spider with whitish mid-dorsal line on the carapace and lateral lines on the abdomen, the latter united dorsally by three more or less distinct transverse whitish lines. Both sexes spin little white sheets across a slightly curved leaflet (pl. xvii, figs. 2-3), usually of *Glycosmis pentaphylla*, and live singly beneath them. They mature in October or thereabouts, after which the female deposits a number of clusters of eggs on the surface of the leaf which has formed her home. The European *D. viridissima* (Walckenaer) appears to have similar habits (Simon, 1892 *a*, p. 234).

Family ERESIDAE.

Stegodyphus sarasinorum, Karsch.

Stegodyphus sarasinorum, Pocock, 1900, p. 209, fig. 65.

Colonies of this spider are rare on the island, though abundant on the mainland near by. For an account of the habits see Gravely, 1915*b*, pp. 534-536, where other references will be found.

Family FILISTATIDAE.

Filistata sp.

A species of *Filistata* is common, especially in termite runs on tree trunks and under bark. It appears to make use of old nests made by other spiders, and is often found among foliage in what seem to be deserted nests of the species of *Amaurobius* (Fam. Dictynidae) above referred to.

Only females have yet been found. They probably belong to the *Filistatoides* group.

Family SICARIIDAE.

Scytodes sp. nr. *pallida*, Doleschall.

This species closely resembles *T. pallida*, Doleschall (1859, p. 48, pl. vi, figs. 3-3*b*) in general appearance, but differs in the arrangement of the dark lines on both carapace and abdomen. On the carapace there are 5 (sometimes 7) longitudinal dark lines, one being always median, whereas in *S. pallida* there is no median line, the total number being an even one (probably six), judging from Doleschall's figure. On the abdomen there are three or four more or less complete transverse black lines and none of the longitudinal ones found in *S. pallida*.

The Barkuda species, like *S. pallida* (Simon, 1892 *a*, p. 276), lives among foliage, making itself a retreat by spinning together a few leaves.

Family DYSDERIDAE.

Ariadna ? *nebulosa*, Simon.

Ariadna nebulosa, Simon, 1906, p. 280.

A species of *Ariadna*, possibly identical with Simon's *A. nebulosa* from Madura, is common under stones and among loose soil, where it spins long tubes of soft but moderately tough whitish silk of very characteristic texture and appearance.

Family DRASSIDAE.

Several small species are to be found under stones, among loose soil, in crevices in the bark of trees and on foliage. I have not been able to identify any of them.

Family PALPIMANIDAE.

Sarascelis ? *raffrayi*, Simon.

Sarascelis raffrayi, Simon, 1893, p. 313.

A bright orange-red spider occasionally found under stones or on tree trunks. The sexes appear to occur in about equal numbers, and do not differ from one another except as regards the sexual organs.

Mature males vary from $3\frac{1}{2}$ –5 mm. in length, the largest female being $6\frac{1}{2}$ mm. long. The type of *S. raffrayi* was a male 7 mm. long—much larger than either of the Barkuda males, and twice as long as the smaller of the two. Apart from this difference in size Simon's description of *S. raffrayi* appears to apply to the Barkuda specimens.

Family ZODARIIDAE.

Hermippoides arjuna, gen. et. sp. nov.

Text-fig. 2e.

A medium sized and somewhat rotund black spider spotted with white, found running about under trees and occasionally on foliage. The genus differs from *Hermippus*, Sim. (1892, p. 425) only in the possession of all six spinnerettes, instead of only one pair of them.

The anterior row of eyes is very slightly procurved, with the medians slightly larger than the laterals and separated from each other by little more than half a diameter and from the laterals by about one and a half diameters. The posterior row is slightly wider and more procurved than the anterior; its eyes are about equal in size to the anterior laterals. The ocular quadrangle is practically square, but the posterior laterals, being smaller than the anterior laterals, are more widely separated.

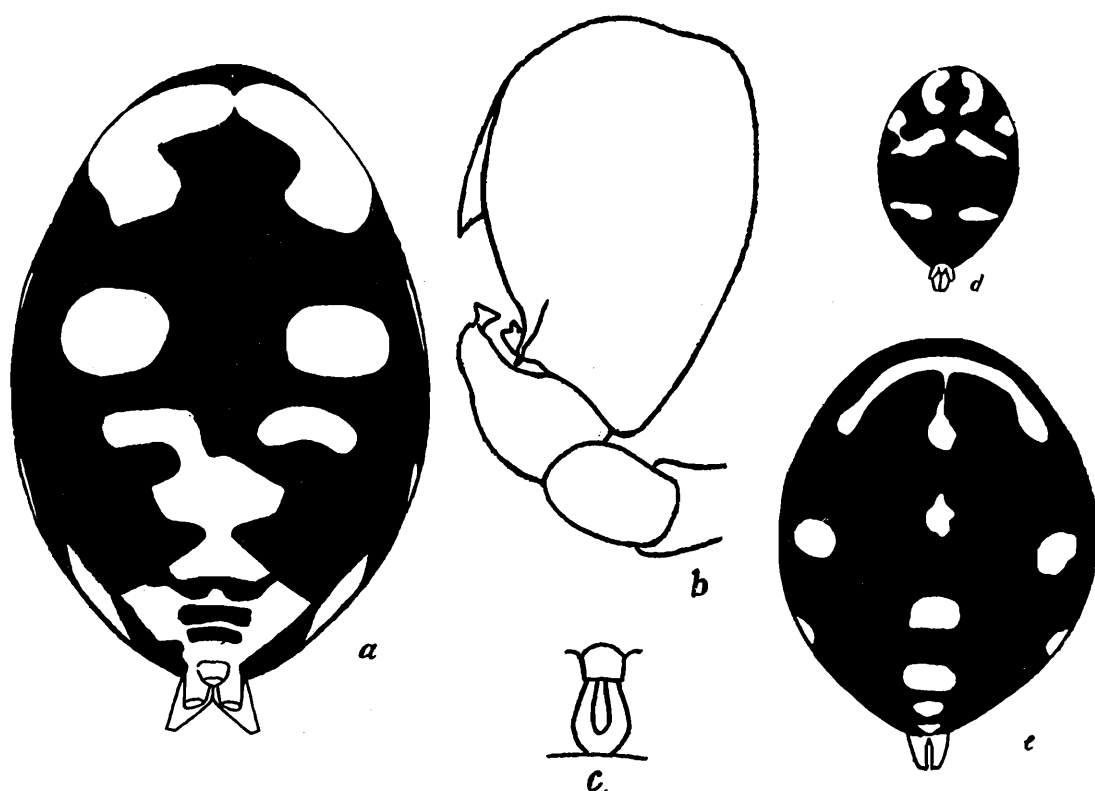
The cephalothorax is blackish brown, with a white margin ventrally. The sternum and labium are brown. The appendages and spinnerettes are pale yellowish, except the tarsus of the palp which is brown. The abdomen (text-fig. 2 e) is black with five whitish longitudinal lines or rows of spots. The mid-dorsal row is straight and consists of about ten spots, of which the posterior are more crowded together than the anterior. The foremost spot is, however, united by a thin line with the second spot of its own row and with the foremost spot of the lines next to it on either side, which together produce the figure of a bow and arrow (without the cord). The dorso-lateral rows each consist of the spot included in this figure and three others behind it, all separate. The ventro-lateral row consists of four or five spots, often partially united, of which the third is somewhat out of line, being at a higher level than the rest. Ventrally there is a pair of wavy and more or less broken lines. There is also a small spot close to the spinnerettes, towards which the two lateral rows of spots tend to converge;

and there may be a more or less conspicuous pair of spots immediately behind the lung-sacs, between the ventral and ventrolateral lines.

Storena birenifer, sp. nov.

Text-fig. 2 a-c.

A medium sized dark brown spider with conspicuous ochraceous markings, found among soil and stones under shady trees in the jungle. Males were obtained in July. They differ from females chiefly in the smaller relative size of the abdomen, and in having the anterior median eyes distinctly larger than the rest.



TEXT-FIG. 2.

- a. *Storena birenifer* ♀ dorsal surface of abdomen.
 b. " " ♂ left palpal organ.
 c. " " ♀ genital aperture.
 d. *Suffucia cingulata* ♀ dorsal surface of abdomen.
 e. *Hermippoides arjuna* ♀ " " " "

The species appears to resemble *S. redimita*, Simon (1905, pp. 173-4) from Pondicherry and Genji, but the anterior median eyes of the female are scarcely larger than the anterior laterals, instead of almost twice as large as in that species.

The carapace is black. The abdomen (text-fig. 2a) is black with conspicuous pale ochraceous markings as follows: an anterior pair of kidney-shaped patches, more or less confluent across the middle line in front, followed first by a pair of large and then a pair of smaller spots of the same colour. The posterior pair are often confluent with a median triangular patch behind them, and this usually joins the anterior angle of the posterior median patch,

which has the form of a more or less complete square with one angle directed forwards and the opposite one in contact with the spinnerettes. This square, however, contains about three transverse black bars, or pairs of spots, which may be confluent with the black ground colour, thus breaking up part of the outline of the square. In front of the lateral angles of the square the sides of the abdomen bear three parallel oblique ochraceous bars. The ventral surface is ochraceous with a pair of dark longitudinal bands, confluent behind and extending forwards not quite as far as the genital orifice.

The genital orifice of the female is shown in text-fig. 2c.

The palpi and legs are yellowish, except the palpal organ of the male and the femora of both sexes, which are brown or black. The palpal organ of the male is shown in text-fig. 2b. Its tarsus is flattened dorsally and somewhat keeled laterally.

? *Storena* sp.

A minute spider with yellowish feet, darker femora, dark reddish carapace and black abdomen, the abdomen adorned in the male with five conspicuous white spots arranged in a pentagon, the median spot behind the two pairs.

Males were found running in the open on a jungle path after rain; females were found among soil; both were found during August. The species is closely allied to *Storena*, with which it agrees in the form of the sternum, and in the possession of 6 mammillae and a high clypeus. It differs, however, from all representatives of the genus with which I am familiar in having the lateral eyes of both rows obliquely elongate and in having the anterior row recurved. The outer ends of the anterior and posterior laterals are in contact with one another, the posterior row being strongly procurved. The median eyes are separated by about a diameter, forming a quadrangle which is more or less distinctly wider behind than in front, and about as long as it is wide.

Length of female about $2\frac{1}{2}$ mm.; male slightly smaller. I do not feel justified in giving a name to this minute spider without further material for comparison.

Suffucia cingulata, Simon.

Text-fig. 2d.

Suffucia cingulata, Simon, 1905, p. 174.

Both sexes of this minute spider were found running about among dead leaves and in the open after rain during August.

The Indian Museum collection includes specimens from Ross Island in the Andamans (females only, Mr. C. Paiva), Serampore near Calcutta (female only, Mrs. Drake) and Madras (male only, Prof. Ramuni Menon). The species was described from females from Pondicherry.

♀ The markings are very variable in extent and the posterior pair of transverse spots may be absent, as they appear to have been from Simon's specimens. The ground colour of the abdomen is black, and the markings pale ochraceous including the spot on which the anal papilla stands; but the papilla itself is of a snowy white.

♂ The male is slightly smaller than the female, being only about $2\frac{1}{2}$ mm. long, and has the dorsal surface of abdomen of a lustrous blue-black hue throughout, except for the minute white anal papilla.

Family HERSILIIDAE.

Hersilia savignyi, Lucas.

Hersilia savignyi, Pocock, 1900, p. 241.

Common on tree-trunks on the sandy shore of the northern end of the island.

Family PHOLCIDAE.

Artema atlanta, Walck.

Artema atlanta, Pocock, 1900, pp. 238-9, text-fig. 81.

One specimen found in the house.

Smeringopus sp.

A spider with small but somewhat elongate body and immensely long legs, which spins untidy cobwebs in hollow trees and sometimes among the lowest branches of Prickly Pears. It appears to form the chief article of diet of a remarkable Attid (*Linus* sp., see below, p. 419). It is very like *S. elongatus*, but differs in the structure of the vulva. The specimens in the Indian Museum collection suggest that it is a widely distributed jungle spider, while *S. elongatus* lives mainly in houses.

Family THERIDIIDAE.

Rhomphaea sp.

A single spider, apparently belonging to the genus *Rhomphaea*, was found in an irregular web together with a specimen of one of the species of *Theridon* referred to below. The latter was much the larger spider of the two, and doubtless the rightful owner of the web.

Argyrodes scintillulana, Cambridge.

Argyrodes scintillulana, Cambridge, 1880, pp. 332-3, pl. xxxi, fig. 10.

This species is occasionally found in webs of *Cyrtophora cicatrosa*, Stoliczka.

***Argyroides argentata*, Cambridge.**

Argyroides argentata, Cambridge, 1880, pp. 325-6, pl. xxviii, fig. 5.

This species also occurs on the island.

? *Theridion* spp.

One or more species of *Theridion*, varying considerably in colouration, spin irregular snares of the usual type among Prickly Pear and other bushes, living in these webs under a dead leaf or some such shelter.

Another species, closely resembling the European *Lithyphantes paykullianus* in colour, and possibly belonging to the same genus, lives on the ground.

Family ARGIOPIDAE.***Tetragnatha gracilis*, Stoliczka.**

Tetragnatha gracilis, Pocock, 1900, pp. 214.

This species, which is known to occur from India and Ceylon to Celebes and Amboina, usually spins its webs with a twig, on which it rests, across the centre.

***Tetragnatha mandibulata*, Walckenaer.**

Common on sedges at the edge of the tank, and on small bushes on the shore of the lake, where it rests by day, coming out to spin its webs at dusk. Recorded from numerous localities extending from Mauritius and the Seychelles to the Sandwich Islands.

***Tetragnatha viridorufa*, sp. nov.**

This is a jungle spider, rather than a frequenter of water. It spins its web among bushes, and spends the day on a leaf besides it, where its bright reddish brown back and legs and green flanks help to render it inconspicuous in spite of its large size.

The ocular quadrangle is practically square—if anything slightly longer than wide and wider in front than behind. The lateral eyes are much nearer to each other than are the medians. The chelicerae are much longer than the cephalothorax and are strongly divaricate. In the female the first tooth on the ventral margin of the fang groove is situated close to the base of the fang and is much stouter than the corresponding tooth on the dorsal margin, which is situated a little further back. The first five dorsal teeth and the first seven ventral extend over about two-thirds of the length of the basal segment, the remaining teeth being crowded into the remaining one-third. The fang is unarmed and almost straight.

In the male there is the usual strong sub-apical dorsal tooth, which is simply curved and pointed. The fang groove teeth are less numerous than in the female, and the first two of the dorsal

row are much larger than any of the others. The fang is armed on the inner side with a very characteristic truncate tooth set in the middle of the basal curve; it is very slightly curved in the middle and somewhat strongly at the tip.

Figures and comparisons with other species are given in another paper now in the press (Gravely, 1921).

***Leucauge decorata* (Blackwall).**

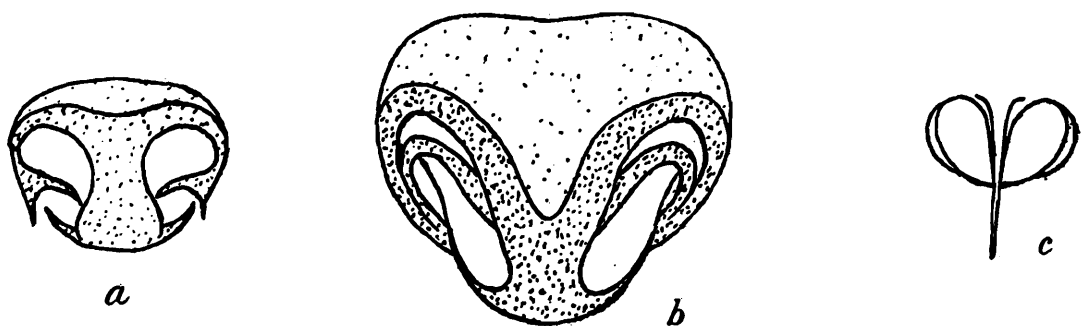
Argyropeira celebesiana, Pocock, 1900, p. 216.¹

A few specimens which probably belonged to this species were once seen on their horizontal webs among bushes.

***Leucauge fastigata* (Simon).**

Argyropeira fastigata, Pocock, 1900, p. 216.

Not uncommon in open spaces in shady jungle, across which the female spins large and more or less horizontal webs. The male



TEXT-FIG. 3.

- a. Vulva of *Argiope anasuja*.
- b. " " " *pulchella*.
- c. " " " *Araneus viridisoma*.

is minute and spins small webs among bushes, where it is very hard to find.

***Argiope anasuja*, Thorell and *A. pulchella*, Thorell.**

Text-fig. 3a, b.

Argiope anasuja, and *A. pulchella*, Pocock, 1900, p. 221-222.

The general shape of the vulva of the female of *A. pulchella* is extremely variable. The thickened margin and partition seem as a rule to approximate more nearly to a T- and less to a Y-shape in the Indian Peninsula than in Burma, but in Bengal the variation is such as to suggest at first sight that *A. anasuja* from India and *A. pulchella* from Burma are no more than local races of one species. They can, however, readily be distinguished

¹ See Simon, 1906, p. 282, for synonymy and an account of the differences between *L. decorata* and *L. celebesiana*; see also Gravely, 1921.

by the internal sclerite, which in *A. pulchella* is very large and situated beside the anterior wall of the aperture, and in *A. anasuja* is smaller and situated beside the posterior wall (see text-figs. 3a, b). The anterior median eyes are, moreover, much more prominent in *A. pulchella* than in *A. anasuja* in the female sex. But I have been unable to find any character by which to distinguish the males. Both species occur on Barkuda Island.

Cyrtophora cicatrosa, Stoliczka.

Araneus cicatrosus, Pocock, 1900, p. 226.

The dome-shaped webs of this spider are very abundant among Prickly Pear. They are frequented by the slender Reduviid bug *Eugubinus reticolus*, hitherto recorded only from Bengal, and also by *E. intrudens*, hitherto only recorded from Cochin. I have nothing to add to my previous record of the habits of these bugs, which appear to live mainly on the eggs of this spider (1915b, pp. 512-3). Single specimens of the larger and still more slender Reduviid *Ischnobaena henrici* have twice been found in the webs. I have not been able to make any definite observations on this association, but it is unlikely, I think, to have been accidental, both on account of the similarity of form between *Ischnobaena* and *Eugubinus* and because both seem equally at ease in the webs. The presence of cast skins, moreover, proved that the specimens had grown up in the webs from an early stage.

The association of a Uloborid and a Theridiid with *C. cicatrosa* has already been referred to above (pp. 405, 410).

Cyclosa insulana, Costa.

Cyclosa albisternis, Simon, 1888, pp. 285-6.

Cyclosa spirifera, Simon, 1889, pp. 337-8.

Cyclosa insulana, Workman, 1896, pl. 36.

This species is represented in the Indian Museum collection from many localities and proves to be extremely variable both in structure and in colour. The young may be brownish, but are frequently of a glistening metallic silver. The silver colouration may be more or less persistent in the adult, in which various shades of ochre, brown or black more or less marbled with fainter tints are, however, more usual.

The sternum is usually dark brown with a transverse yellow band between the first legs, a spot or radial streak of yellow opposite the bases of the second and third legs and a terminal spot or longitudinal streak between the fourth legs (as in types of *C. spirifera*). It may, however, be uniformly black or uniformly white (as in the type of *C. albisternus*) according to the extent and density of the different pigments.

I can find no constant structural difference between *C. albisternus* and *C. spirifera*. The anterior and posterior eyes of the latter do indeed at first sight appear to be more widely separated

from one another than are those of the former ; but this is I believe really due to the ground-colour of the carapace between them being darker in one than in the other.

The shape of the abdomen and the structure of the vulva are also variable. It is perhaps not unlikely that it may ultimately be possible to distinguish local races by means of the latter, whose median piece, though always variable, is inclined in Himalayan specimens to be markedly broader than in plains specimens and even obtusely triangular.

The shape of the abdomen, in spite of its variability in detail, is sufficiently constant to afford as a rule a ready means of distinguishing the present species from other common forms.

Araneus spp. nr. *nauticus*, Koch.

Pl. xix, 1-6.

All spiders of this series of Simon's third group of the genus appear to be more or less nocturnal, coming out to spin their webs at dusk and leaving them empty by day. Males not infrequently wander into houses in the late evening, presumably when searching for mates, and several were captured thus on Barkuda Island. Several immature specimens were found in their webs among bushes in the jungle after dark, but no adult females have yet been obtained. This is particularly unfortunate as the species are distinguished by the form of the vulva and I have been unable to find any certain means of identifying males or immature specimens. The commonest species in the plains seem to be *A. nauticus* and *A. rumphi*, and it is probable that the specimens all belong to one or both of these species.¹

The colouration of this series of spiders varies in a most interesting manner. Different species often appear to be characterized by different tints ; but closer study seems to indicate that these tints are of local or possibly climatic or even seasonal significance rather than truly specific. The pattern according to which the colours are arranged appears to be the same for *A. nauticus* and *A. rumphi* and for several Himalayan and probably other species also ; and the pattern of any one species seems as a rule (though probably not always) to be constant. The extent to which the different pigments are developed, however, may vary enormously, making different specimens of one species look far less like each other than like corresponding varieties of allied species. The majority of specimens in all species, except possibly *A. masoni* which seems always to be dark, are of a marbled greyish or brownish tint. Departures from this normal type are in three main directions: (a) a general reduction of pigmentation,

¹ Two mature females have since been obtained. One at least appears to be *A. rumphi*. Concerning the other I am more doubtful. A careful examination of large series of all species of the group seems to be needed for a full determination of specific characters.

resulting in paler forms, often more or less uniformly whitish; (b) a general increase of pigmentation resulting in darker forms, often more or less uniformly blackish; and (c) a general reduction of pigmentation throughout areas normally pale, combined with a general increase of pigmentation throughout areas normally dark, resulting in a contrast of black and white areas which, though entirely different in appearance to the fundamental pattern, appears in all cases to be based upon it and as a matter of fact to follow it somewhat closely. This variation is illustrated in the case of *A. rumphii* in pl. xix, figs. 1-6, the specimens shown being from various localities.

***Araneus melanocrania*, Thorell.**

Epeira melanocrania, Thorell, 1887, pp. 209-213.

This species is found chiefly among trees and bushes on the shores of the island. It spins a large orb-web in which it sits by night, but spends the day in a little silken retreat which it constructs close by in a curled leaf or some other suitable hiding place. Males were obtained in December.

***Araneus viridisoma*, sp. nov.**

Text-fig. 3c.

A medium-sized delicate-looking green spider, whitish above, which spins orb-webs in the jungle at night. It was very abundant in some places but was only found by searching with a lantern at night. I never saw it by day. In spirit the green colour disappears completely.

♀ Total length up to $7\frac{1}{2}$ mm. Carapace 3 mm. long by 2 mm. broad. This species belongs to Simon's fourth group of the genus, and its eyes bring it nearest to the series typified by *A. origena* from Java, the medians being arranged in a square, the anteriors slightly smaller than the posteriors, and the anterior line so strongly recurved that the medians appear to touch the edge of the clypeus. The abdomen, however, is short and oval instead of being elongate and is without shoulder projections. The lateral eyes are small and contiguous, together scarcely larger than the posterior medians, with which they form an approximately straight line. The legs are finely hairy, and bear a number of long slender blackish spines. The vulva is shown in text-fig. 3c.

♂ The male resembles the female in colour, but is much smaller. Total length about 5 mm., carapace barely 2 mm. long, and almost equally broad. The anterior median eyes are somewhat larger and more widely separated than the posteriors and are very strongly prominent. Laterals as in the female. The legs resemble those of the female, except the second pair in which the tibia bears a row of four or five stout spines on the basal two thirds of the ventral surface and a group of about four similar spines rather more than half way along the inner surface with a subapical

spine beyond them. There is also a ventral subapical spine, but this is little or no stouter than the other spines with which all the legs are armed.

***Araneus excelsus*, Simon.**

Glyptogona excelsa, Simon, 1889, p. 337.

Araneus excelsus, Simon, 1892 a, p. 820.

A common and widely distributed little spider originally described from the Himalayas. It is mostly found in shady glades.

***Gasteracantha hasseltii*, Koch.**

Gasteracantha hasseltii, Pocock, 1900, p. 233.

***Gasteracantha brevispina*, Doleschall.**

Pl. xix, 7-14.

Gasteracantha brevispina, Pocock, 1900, p. 235.

Both the above species of *Gasteracantha* are to be found seated in their orb-webs in the jungle.

The colour varies in the same way as it does in spiders of the *nauticus* group of *Araneus* (see above, p. 414). This is illustrated in pl. xix, figs. 7-14.

***Paraplectana maritata*, Cambridge.**

Paraplectana maritata, Cambridge, 1877, pp. 32-34, pl. vii, figs. 7 a-e.

„ *nigroanalis*, Van Hasselt, 1882, pp. 15-16, pl. i, fig. 3.

„ *maritata*, Thorell, 1895, p. 209.

A minute yellow and black spider with the dorsal surface of the abdomen much flattened.

Family THOMISIDAE.

Several species occur on Barkuda Island, but there is nothing sufficiently noteworthy for record concerning them, and I am not at present able to identify them.

Family CLUBIONIDAE.

***Sparassus lamarcki*, Latreille.**

Sparassus lamarcki, Pocock, 1900, p. 267.

A large spider of a somewhat rich brown colour, with densely scopulate tarsi and metatarsi. It lives among foliage, where it makes its lair by spinning loosely together the edges of one or two big leaves. A female was found in the clutches of a fossorial wasp much smaller than itself. Two males were found in the house in August; in neither of them is the black median area on the ventral surface of the abdomen as well developed as in the female, and in one it is practically non-existent. Its identity is,

however, established by the structure of its palps which differ from those of *S. impudicus*, to which, in the absence of this patch, the specimen would appear from Pocock's key (1900, p. 266) to belong.

Sparassus sp.

Two specimens, superficially very like *Palystes flavidus*, with which they were confused in life. Both have the red median band sometimes found on the lower surface of the abdomen of that species developed into a dark and broad reddish brown patch.

Heteropoda sp.

A species of *Heteropoda* is common among stones and dead leaves and on foliage and Prickly Pear. The same species is found in Madras. The male agrees closely with Pocock's brief description of *H. sexpunctata*, Simon, in the "Fauna of British India" series (1900); but the lobes of the vulva of the female, though different from those of *H. venatoria*, are in contact behind, instead of being separated throughout by a hammer-shaped median sclerite.

Palystes flavidus, Simon.

Palystes flavidus, Pocock, 1900, p. 266.

A moderately large Heteropodiform spider common among foliage, where it spins a few leaves loosely together to form its lair. The female is pale green in colour, the male more of a yellowish green with still more yellow legs. The lower surface of the abdomen sometimes bears a more or less broad longitudinal red band behind the genital aperture.

Clubiona spp.

Single specimens of two species apparently belonging to this genus have been found on the island. One, of a pale yellowish colour, was found among foliage. The other, which was much darker and of a browner tint, was dug up from among the underground galleries of a termite nest, round about which were numerous *Damarchus* burrows.

Gen. nov. ? near Syrisca.

A smaller and somewhat slenderer spider than the two last, of a moderately dark brownish colour, not uncommon among soil and under bark at the bases of trees. It appears to differ from *Syrisca* in having the posterior median eyes somewhat further from each other than from the posterior laterals instead of somewhat nearer together.

Sphingius sp.

A small spider found with *Corinnomma* and *Oedignatha* among loose soil. The same or a closely allied species occurs at Banga-

lore. In Madras it appears to be replaced by a larger species with transverse bands of whitish hairs on the abdomen, and a somewhat different vulva.

Corinnomma sp.

Two species are not uncommon. Both may readily be mistaken for ants when running about with them among dead leaves on open ground. In the larger species (about 10 mm. long) both sexes run about thus. The smaller species (about 5 mm. long) lives among fine soil and dead leaves at the bases of trees; but its males run about on the surface together with the larger species.

Oedignatha scrobiculata, Thorell.

Pl. xvii, fig. 1.

Oedignatha scrobiculata, Thorell, 1881, p. 209.

„ „ Simon, 1897, p. 14 and 1906, p. 302.

Also known from Ceylon, the Malabar Coast and Penang.

A spider of about the same general size and appearance as the smaller of the two species of *Corinnomma*, and found under the same conditions. It makes a lair for itself, however, by roofing over a small cavity in the ground with soil fastened together with silk, thus making an oval chamber with a tubular aperture directed upwards at each end. The nests are easily seen and can be recognized by the circular lips of the apertures projecting slightly above the surface of the soil (see pl. xvii, fig. 1).

Family LYCOSIDÆ.

Hipassa pantherina, Pocock.

Hipassa pantherina, Pocock, 1900, p. 250.

This is probably the commonest Lycosid on the island. I have already published a note on its habits, under the generic name *Pardosa*, which I have since found to be incorrect (1915 *b*, p. 539). It spins a silken platform with a tube leading back from it into a crevice, usually in a tree or among stones.

? **Lycosa** spp.

The remaining species of Lycosidae probably all belong to the genus *Lycosa*, but it seems impossible to name them without much more extensive work on the Indian species of the genus as a whole than I am yet in a position to undertake. The largest species (probably two in number) live in short holes in the ground, from which they emerge to run about among stones and dead leaves. A much smaller and more delicate looking species runs about among decaying debris on the sandy shores of the lake; and other still smaller species have been found in various open spaces.

Family OXYOPIDAE.

Peucettia viridana (Stoliczka).

Peucettia viridana, Pocock, 1900, pp. 255-6, fig. 86.

A large green Oxyopid, with the abdomen of young specimens and the legs of adults often reddish below, the upper surface of the abdomen ornamented with whitish lines, the legs covered with numerous large black spines.

Its colour and spiny legs make it most inconspicuous on plants bearing glandular hairs, such as *Jatropha gossypifolia*, in whose foliage it most frequently makes its home.

Peucettia and Oxyopes spp.

Several other Oxyopids occur among foliage, none of which I am at present able to determine. They are much less common and for the most part much smaller than *P. viridana*.

Family ATTIDAE.

Numbers of Attids, including some of the ant-mimicing species, are common on Barkuda Island; but it is impossible to deal with them satisfactorily without going much more fully into the Indian species generally than is possible in the present paper. One form, however, requires special mention on account of its habits. Its curious appearance makes it easy to identify generically.

Linus sp.

Pl. xiv, fig. 15.

A moderately large jumping-spider of mottled brown colour and normal form, but rendered peculiarly grotesque by projecting tufts of hair on the body and localized fringes on the legs (pl. xiv fig. 15). It lives in crevices of *Ficus* and other trees, from the bark of which it is not easily distinguishable until it moves. It feeds upon the Pholcid, *Smeringopus* sp. (see above, p. 410) into whose untidy webs it walks apparently without any difficulty till within striking distance, when it raises itself slowly on its hind legs and then springs like a flash upon its prey, which by this time is usually swinging rapidly to and fro on its long legs, as Pholcid spiders in common with Phalangids and Tipulid flies habitually do when alarmed.

I once found a young *Linus* in the web of *Cyrtophora cicatrosa*, whose obvious alarm had attracted my attention; but I have never known a *Cyrtophora* to be eaten even by an adult *Linus*. On the first occasion on which I tried the experiment the *Linus* made straight towards the spider into whose web I had introduced it; the *Cyrtophora* became greatly alarmed, rushed madly round inside its dome and eventually escaped. On a subsequent occasion, in another web, the *Cyrtophora* closely watched the move-

ments of the *Linus* and was evidently prepared to defend itself, but neither seemed anxious to take the initiative in a fight. Consequently I had to end the affair by recapturing the *Linus* before anything definite had happened.

Linus makes an irregular cocoon of silk mixed with earth round its eggs, which it hangs among the cobwebs in which it lives. The mother clings to the cocoon till the young are hatched.

The same or a closely allied species occurs in Madras.

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